43. The apparatus of claim 38, wherein the susceptor has therein a cooling line adapted to control a temperature of the wafer. --

REMARKS

Reexamination and reconsideration of the present application are requested.

Applicants have amended the specification to correct a minor typographical error. Applicants have also cancel claims canceled claims 1-6 and 12-37 without prejudice or disclaimer thereof, and added new claims 38-43. Accordingly, claims 7-11 and 38-43 remain pending in the application.

35 U.S.C. § 102

The Examiner rejected claims 7 and 11 under 35 U.S.C. § 102 as allegedly being anticipated by Shinriki et al. U.S. patent 6,143,081 ("Shinriki"). Applicants respectfully traverse there rejections for at least the following reasons.

Among other things, the apparatus of claim 7 includes a heater installed at an upper portion of the processing chamber.

Shinriki clearly teaches that the wafer W is heated by the heating resistor 220 buried within the mounting table beneath the wafer (see, e.g. col. 13, lines 37-40; col. 14, lines 24-29). The element 280 cited by the Examiner is not a heater installed at an upper portion of the processing chamber, but instead is a UV lamp installed outside the process chamber 204 and which merely serves to generate active oxygen atoms from ozone or N_2O gas (see col. 11, line 66 - col. 12, line 1; col. 12, lines 8-9).

Therefore, it is apparent that Shinriki fails to disclose a heater installed at an upper portion of the processing chamber.

.Accordingly, Applicants respectfully submit that the apparatus of claim 7 is patentable over Shinriki. Claim 11 dependent from claim 7 is deemed similarly allowable.

35 U.S.C. § 103

The Examiner rejected: claims 7-8 and 11 under 35 U.S.C. § 103 as allegedly being unpatentable over Iida et al. U.S. Patent 5,527,417 ("Iida") in view of Yin et al. U.S. patent 6,189,484 ("Yin"); claims 7 and 11 under 35 U.S.C. § 103 as allegedly being unpatentable over Iida in view of Shinriki; and claims 9 and 10 under 35 U.S.C. § 103 as allegedly being unpatentable over Iida in view of Yin and further in view of Shang et al. U.S. Patent 6,189,484 ("Shang"). Applicants respectfully traverse these rejections for at least the following reasons.

Claims 7,8 and 11 are patentable over Iida and Yin

At the outset, Applicant is not sure what element in Iida the Examiner believes corresponds to the claimed susceptor. The Examiner has not specifically identified any such element. Clarification is respectfully requested.

Among other things, the apparatus of claim 7 includes a gas diffuser installed below the heater for supplying reaction gases into the process chamber.

The Examiner has cited element 112 as allegedly corresponding to the recited gas diffuser for supplying reaction gases into the process chamber.

However, Applicants respectfully submit that element 112 cannot correspond to the recited gas diffuser for supplying reaction gases into the process chamber. Iida clearly teaches that the gas flow control plate 112 distributes a non-reactive ***purge gas B*** (e.g., N_2 gas) into the chamber to prevent attenuation of UV rays (see, e.g., col. 9, lines 11-14, 22-27, 42-45). In direct contrast to any diffusion, Iida teaches that the reaction (source) gas A is supplied from a nozzle 110a to flow directly in parallel across the target substrate (see, e.g., col. 9, lines 45-50).

Therefore, for at least this reason, no combination of Iida and Yin could produce the apparatus of claim 7.

Also among other things, the apparatus of claim 7 includes a heater installed at an upper portion of the processing chamber. Iida clearly teaches that the target substrate 106 is heated by the heater 107 disposed beneath the wafer (see, e.g. col. 9, lines 4-5 and FIGs. 1 and 3). The element 102 cited by the Examiner is not a heater installed at an upper portion of the processing chamber, but instead is a UV lamp installed outside the process chamber 105 and which provide light rays for a photo-assisted CVD process (see, e.g., col. 8, line 66 - col.9, line 2).

Therefore, it is apparent that Iida fails to disclose a heater installed at an upper portion of the processing chamber. And the Examiner has fairly admitted that Iida fails to disclose a vertically movable susceptor.

However, it is the Examiner's position that these elements are disclosed in Yin.

At the outset, Applicants respectfully submit that there can be no motivation to modify Iida to include the heater disclosed by Yin. Yin's resistive heater 170 serves to heat its anode electrode. No such anode electrode exists in Iida's apparatus. Furthermore, Iida already has a heater 107/207/306/407/607/704/804 below the substrate for heating the substrate. Therefore, there would be no reason to add another heater above the substrate to heat an anode electrode which is not even present in Iida. .

Therefore, for at least this additional reason, no combination of Iida and Yin could produce the apparatus of claim 7.

Furthermore, Applicants respectfully submit that there is no motivation to modify Iida to include a vertically movable susceptor.

The Examiner has stated that it would have been obvious to modify the apparatus of Iida to include the vertically movable susceptor allegedly disclosed in Yin "because this allows optimization of wafer exposure to plasma, easy removability of the wafer from the processing chamber, and better temperature control of the wafer.

Applicants respectfully disagree.

As to the first supposed motivation, Applicants submit that Iida clearly pertains to a "photo-assisted CVD method, unlike a plasma CVD method" (see, e.g., col. 1, lines 22-23). Accordingly, in Iida the plasma is only applied to clean the process chamber (see, e.g., col. 2, lines 27-37; col. 29, lines 29-43; col. 31, lines 22-41), not to react with any wafer. And indeed, Iida discloses removal of the substrate from the

chamber when the plasma is applied during the cleaning process (see, e.g., col. 14, lines 34-39 and compare FIG 46A with FIGs. 46B and 49).

So, Applicants respectfully submit that Iida does not even disclose that any wafer reacts with any plasma, and therefore there can be no possible motivation to modify the apparatus in Iida to "allow optimization of wafer exposure to plasma."

As to the second supposed motivation, Applicants see nothing in Iida that suggests any difficulty in removing a wafer from the chamber that would motivate any such modification. Indeed, Iida is already provided with a means for removing the wafer from the chamber (see, e.g., col. 14, lines 34-39; col. 13, lines 32-34; col. 18, lines 24-25).

As to the third supposed motivation, Iida discloses an apparatus where a target substrate is heated by a heater 107/207/306/407/607/704/804 disposed beneath the substrate. So, Applicants respectfully submit that there can be no possible motivation to modify the apparatus in Iida to add a vertically movable susceptor to provide "better temperature control of the wafer."

Accordingly, for at least this additional reason, no combination of Iida and Yin could produce the apparatus of claim 7.

Claims 8 and 11 dependent from claim 7 are deemed similarly allowable.

Moreover, as for claim 8, the Examiner has provided no motivation whatsoever for modifying Iida to add a cooling line in a susceptor. Indeed, no such motivation is even possible, as Iida very plainly discloses a device wherein a heating element in disposed beneath the substrate where any susceptor would be. The heater

heats the substrate. Why would one modify the reference to add a cooling line beneath the substrate to cool the substrate when the reference specifically teaches using a heater beneath the substrate to heat the substrate?

For at least this additional reason, claim 8 is deemed allowable over the cited art.

Claims 7 and 11 are Patentable over Iida in view of Shinriki.

At the outset, Applicants agin note that the Examiner has failed to cite any element in Iida as allegedly corresponding to a susceptor. If the Examiner believes that Iida discloses a susceptor, clarification is respectfully requested.

As explained above, Iida fails to disclose a heater installed at an upper portion of the processing chamber, the element 202 instead being a UV light outside the process chamber for a photo-assisted CVD process. Similarly, as explained with respect to the rejection under 35 U.S.C. § 102, Shinriki also fails to disclose a heater installed at an upper portion of the processing chamber, the element 280 also being a UV light outside the process chamber.

Therefore, for at least this reason, no combination of Iida and Shinriki could produce the apparatus of claim 7.

Furthermore, Applicants respectfully submit that there is no motivation to modify Iida to include a vertically movable susceptor "to change the distance between the wafer and the active gas." Indeed, the active gas in Iida is emitted across the top

of the wafer from the side-mounted source gas feed nozzle. So there is no motivation disclosed in the prior art to modify Iida to add a vertically movable susceptor.

Accordingly, for at least these reasons, Applicants respectfully submit that claim 7 is patentable over any combination of Iida and Shinriki. Claim 11 dependent from claim 7 is deemed similarly allowable.

Claims 9 and 10 are patentable over Iida in view of Yin and further in view of Shang.

At the outset, Applicants respectfully submit that Shang does not remedy the shortcomings of Iida and Yin with respect to claim 7 as discussed above.

Claim 9 includes a feature that the gas diffuser comprises a gas supply line for receiving the reaction gases supplied via pipes installed outside the process chamber. Claims 10 includes a feature wherein the pipes include a first pipe having a microwave guide for changing a gas mixture into a plasma state.

The Examiner has stated that is would have been obvious to modify the apparatus of Iida (as modified by Yin) to include the pipe structure of Shang.

However, Applicants respectfully submit that the Examiner's proposed motivation to modify the apparatus of Iida (as modified by Yin) to include the pipe structure of Shang is fatally flawed.

The Examiner has cited element 112 in Iida as allegedly corresponding to the recited gas diffuser for supplying reaction gases into the process chamber. As explained above, element 112 cannot correspond to the recited gas diffuser for

supplying reaction gases into the process chamber. Accordingly, the gas dispensed from the gas flow control plate 112 in Iida is not a cleaning gas, and is not made into a plasma. Therefore, there could be no possible motivation to modify Iida to "result in the capability of cleaning the apparatus without causing the damage that sometime occurs when generating plasma in the processing chamber" as alleged by the Examiner.

Accordingly, for at least these reasons, Applicants respectfully submit that claims 9 and 10 are patentable over any combination of Iida, Yin and Shang.

NEW CLAIMS 38-43

Applicants have added new claims 38-43. Among other things, claim 38 includes a combination of a vertically movable susceptor installed at a lower portion of a processing chamber and adapted to support a wafer thereon, a heater disposed within an upper portion of the processing chamber and adapted to heat the wafer, and a gas diffuser installed within the processing chamber and adapted to supply reaction gases into the process chamber. No apparatus having such a combination of features is disclosed or suggested by any combination of cited prior art references.

CONCLUSION

In view of the foregoing explanations, Applicant respectfully requests that the Examiner reconsider and reexamine the present application, allow claims 7-11 and 38-43, and pass the application to issue. In the event that there are any outstanding

matters remaining in the present application, the Examiner is invited to contact Kenneth D. Springer (Reg. No. 39,843) at (703) 715-0870 to discuss these matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 50-0238 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17, particularly extension of time fees.

Respectfully submitted,

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Date: 4 October 2002

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Version with Markings to Show Changes Made

In the specification:

Paragraph beginning at line 22 of page 13 has been amended as follows:

In the state where the vertically movable susceptor 12 is placed at the lower portion of the vacuum chamber 10, the silicon wafer 14 is loaded onto the susceptor 12. In order to create a vacuum condition in the vacuum chamber 10, the air or gases present in the vacuum chamber 10 are exhausted via the exhaust hole 24 and the fourth pipe 26 using the switching value 28 and the vacuum pump 30. Then, cooling water and gases are supplied to the cooling line 16a in the susceptor 12 via the first pipe 16 from the cooling water/gas supply device 18, to control the temperature of the susceptor 12, i.e., the temperature of the silicon wafer 14 on the susceptor 12. The hydrogen gas and the fluorine-containing gas in a plasma state are supplied into the vacuum chamber 10 (i.e., downflowing process) for a chemical reaction with the oxide layer formed on the silicon wafer 14. When the chemical reaction no longer proceeds due to generation of a reaction layer (not shown), the susceptor [10] 12 is moved to the upper portion of the vacuum chamber by the operation of the vertically movable shaft 20 and the motor 22. Then, the heater 54 installed at the upper portion of the vacuum chamber 10 is operated to anneal the silicon wafer 14 mounted on the susceptor 12, thereby vaporizing the byproduct of the reaction between the oxide layer and the reaction gases, i.e., the reaction layer. The vaporized byproduct is exhausted through the exhaust hole 24 and the fourth pipe 26. Then, the susceptor 12

which has been moved up from its initial position for the annealing process is moved back to the lower portion of the vacuum chamber 10 using the vertically movable shaft 20 and the motor 22.

In the Claims:

Claims 1-6 and 12-37 have been canceled.

Claims 38-43 have been added